**Scientific Inquiry**

**2-1 The student will demonstrate an understanding of scientific inquiry, including the processes, skills, and mathematical thinking necessary to conduct a simple scientific investigation.**

**2-1.1 Carry out simple scientific investigations to answer questions about familiar objects and events.**

**Taxonomy Level:** 3.1-A Apply Factual Knowledge

**Previous/Future knowledge:** In 1st grade (1-1.3), students carried out simple scientific investigations when given clear directions. In 3rd grade (3-1.3), students will generate questions such as "what if?" or "how?" about objects, organisms, and events in the environment and use those questions to conduct a simple scientific investigation. In 5th grade (5-1.3), students will plan and conduct controlled scientific investigations, manipulating one variable at a time.

**It is essential for students to** answer questions about familiar objects and events through performing simple scientific investigations. Clear directions for a scientific investigation may include instructions to:

- Ask a question to be investigated
- Make a prediction (possible answer to the question)
- Decide what materials are needed for the investigation
- List steps to follow to carry out the investigation
- Record observations
- Communicate the results (for example through verbal discussion, pictures, diagrams, note-booking, etc.)

To make a *prediction*:

- Make observations and think about what is known about the object or event.
- Tell what will happen next.

NOTE TO TEACHER: The directions should be presented visually or orally in a manner that is suited to the students' levels of development.

**It is not essential for students to** devise the steps to carry out a scientific investigation or know the terms manipulated and responding variable.

**Assessment Guidelines:**

The objective of this indicator is to *carry out* simple scientific investigations to answer questions about familiar objects and events; therefore, the primary focus of assessment should be to follow the steps for completing a simple investigation when provided with the steps. However, appropriate assessments should also require students to *recall* that a scientific investigation begins with a question.

**Scientific Inquiry**

**2-1 The student will demonstrate an understanding of scientific inquiry, including the processes, skills, and mathematical thinking necessary to conduct a simple scientific investigation.**

**2.1.2 Use tools (including thermometers, rain gauges, balances, and measuring cups) safely, accurately, and appropriately when gathering specific data in US customary (English) and metric units of measurement.**
**Taxonomy Level:** 3.2-B Apply Factual Knowledge

**Previous/Future knowledge:** In previous grades, students used magnifiers and eyedroppers (K-1.2) and rulers (1-1.2) safely, accurately, and appropriately. In future grades, students will continue to use these tools, when appropriate, as well as use new tools when collecting scientific data. A complete list of tools can be found in Appendix A of the Academic Standards.

**It is essential for students to** know that every simple scientific investigation provides information. This information is called *data*. Data can be simple observations or measurements (in US customary/English and metric units).

**It is essential for students to** know that different tools are needed to collect different kinds of data.

- A *thermometer* is a tool that measures temperature.
  - When using a thermometer, make sure not to place the bulb of the thermometer on the bottom or sides of the container or touch the bulb when taking air temperature.
  - When reading the temperature on a thermometer, it should be vertical and at eye level with the top of the liquid in the glass tube.
  - A thermometer measures temperature in degrees Fahrenheit ($^{o}$F) and Celsius ($^{o}$C) to the nearest degree.

NOTE TO TEACHER: Fahrenheit will be used to measure weather data only. All other temperature readings will be taken using the Celsius scale.

- A *rain gauge* is a tool that measures the amount of rainfall.
  - To collect rainfall accurately, the rain gauge must be in an open area.
  - To read the rain gauge, hold it at eye level.
  - A rain gauge measures the amount of rainfall in inches (in).
- A *balance* is a tool that measures the mass of an object compared to a known mass. *Mass* is the amount of *matter*, or material, in an object.
  - When using a *pan* or *bucket* balance, be sure the balance pointer begins at zero (is level).
  - Place the object being measured on one side.
  - Place the known masses on the opposite side until the balance is level and the pointer is again at zero.
  - When the balance is level, the mass of the object is equal to the total of the known masses.
  - A balance measures the mass of an object in grams (g).
- A *measuring cup* is a tool that measures volume.
  - To read the measuring cup, place the cup on a level surface.
  - When using the measuring cup to measure volume of a solid, be sure the top surface of the solid is level.
  - A measuring cup measures volume in fluid ounces (oz), parts of a cup (c), milliliters (mL), or liters (L).

**Scientific Inquiry**

**2-1 The student will demonstrate an understanding of scientific inquiry, including the processes, skills, and mathematical thinking necessary to conduct a simple scientific investigation.**

**It is essential for students to** use care when handling these tools when gathering data.

- Care should be taken not to break the thermometers, rain gauges, or measuring cups.
- Use only thermometers with colored alcohol in them (such as red or blue), NEVER mercury thermometers (silver liquid in them).
- Remove all objects and known masses from the balance when measuring is completed.

**It is also essential for students to** use tools from previous grade levels that are appropriate to the content of this grade level such as eyedroppers, magnifiers, or rulers (measuring to centimeters), to gather data.

NOTE TO TEACHER: See previous grade information regarding how to use each tool.

**It is not essential for students to** use a beam balance, beakers, or graduated cylinders. Students do not need to measure in pints, quarts, or gallons. Students do not need to convert measurements from English to metric or metric to English.

**Assessment Guidelines:**
The objective of this indicator is to *use* tools safely, accurately, and appropriately when gathering data; therefore, the primary focus of assessment should be to apply correct procedures to the use of thermometers, rain gauges, balances and measuring cups and other tools essential to the grade level that would be needed to conduct a science investigation. However, appropriate assessments should also require students to *identify* appropriate uses for magnifiers and eyedroppers; *illustrate* the appropriate tool for an investigation using pictures, diagrams, or words; *recall* how to accurately determine the measurement from the tool; or *recognize* ways to use science tools safely, accurately, and appropriately.

**Scientific Inquiry**

**2-1 The student will demonstrate an understanding of scientific inquiry, including the processes, skills, and mathematical thinking necessary to conduct a simple scientific investigation.**

2.1.3 **Represent and communicate simple data and explanations through drawings, tables, pictographs, bar graphs, and oral and written language.**
**Taxonomy Level:** 2.1-B Understand Conceptual Knowledge

**Previous/Future knowledge:** In kindergarten students gave explanations based on observations made or previous experiences. This is the first time students will represent or communicate simple data in drawings, tables, and graphs, and give explanations based on the represented data. In 3rd grade (3-1.6), students will infer meaning from data communicated in graphs, tables, and diagrams. In 4th grade (4-1.6), students will construct and interpret diagrams, tables, and graphs made from recorded measurements and observations. In 5th grade, students will communicate the results of a simple technological design by using descriptions, models, and drawings (5-1.7) and communicate the findings of an evaluation in oral or written form (5-1.8).

**It is essential for students to** know that the data collected in simple scientific investigations should be organized in a way that represents and communicates simple data and explanations through drawings, tables, pictographs, bar graphs, and oral and written language. All drawings, tables, pictographs, and bar graphs need to be clearly labeled.

- *Drawings* may be pictures or diagrams used to represent an observation.
- *Tables* organize and represent information collected or presented.

NOTE TO TEACHER: Tables are made of columns and rows. Categories are listed in the first (left) column and data collected are listed in columns to the right of the category column.

- *Pictographs* use pictures or symbols to represent numerical data.
- *Bar graphs* show numerical data for a specific category (such as animals in the zoo or the amount of rainfall in different seasons).

NOTE TO TEACHER: The numbers are represented by the lengths of the bars. The members of the category are labeled on the side-to-side line at the bottom of the graph (horizontal axis); the numbers are marked on the up-and-down line (vertical axis).

- *Oral and written language* can be used to describe observations, share data, or explain results.

**It is not essential for students to** draw line or pie/circle graphs.

**Assessment Guidelines:**
The objective of this indicator is to *represent* and communicate simple data and explanations through drawings, tables, pictographs, bar graphs, and oral and written language; therefore, the primary focus of assessment should be to show and describe observations or data using forms listed in the indicator. However, appropriate assessments should also require students to *recall* how drawings, tables, pictographs, and bar graphs should be labeled.

**Scientific Inquiry**

**2-1 The student will demonstrate an understanding of scientific inquiry, including the processes, skills, and mathematical thinking necessary to conduct a simple scientific investigation.**

**2.1.4 Infer explanations regarding scientific observations and experiences.**
**Taxonomy Level:** 2.5-B Understand Conceptual Knowledge

**Previous/Future knowledge:** In kindergarten (K-1.3), students predicted and explained information or events based on observations or previous experiences. In 3rd grade, students will infer meaning from data communicated in graphs, tables, and diagrams (3-1.6) and explain why similar investigations might produce different results (3-1.7). In 4th grade (4-1.4), students will distinguish among observations, predictions, and inferences. In 7th grade (7-1.6), students will critique a conclusion drawn from a scientific investigation.

**It is essential for students to** give a logical explanation based on scientific observations, evidence, or knowledge gained from past experiences.

Scientific observations are made by using the senses or taking measurements. Making *observations* is a way of learning about the world around us.

- A *scientific observation* is one that anyone can make and the result will always be the same. For example, the animal is black, has four legs, and feels soft.
- An *unscientific observation*, or an opinion, is one that not everyone may agree on. For example, the dog is happy.
- Observing does not mean just looking at something. It involves the use of several or all of the five senses (seeing, hearing, smelling, touching, and tasting) using appropriate observation methods for each sense, such as wafting an odor so that its smell can be described or gently touching the edges of seashells to determine their textures.
- Tasting in science should only be done with the permission of the teacher under controlled conditions.
- Observing helps to find out about objects (their characteristics, properties, differences, similarities) and events (what comes first or last, or what is happening at a particular moment).

To make an *inference*,

- Observe an object or event
- Think about what was observed, considering past experiences
- Give an explanation for what was observed
- Make more observations of the object or event
- Think and explain again

**It is not essential for students to** distinguish between an observation and an inference.

**Assessment Guidelines:**
The objective of this indicator is to *infer* explanations regarding scientific observations and experiences; therefore, the primary focus of assessment should be to give reasonable explanations from observations or experiences. However, appropriate assessments should also require students to *recognize* a scientific observation; or *match* explanations and observations.

**Scientific Inquiry**

**2-1 The student will demonstrate an understanding of scientific inquiry, including the processes, skills, and mathematical thinking necessary to conduct a simple scientific investigation.**

**2-1.5 Use appropriate safety procedures when conducting investigations.**
**Taxonomy Level:** 3.2-C Apply Procedural Knowledge

**Previous/Future knowledge:** In all grades students use appropriate safety procedures when conducting investigations that are appropriate to their grade, tools, and type of investigations.

**It is essential for students to** know that care should be taken when conducting a science investigation to make sure that everyone stays safe.

Safety procedures to use when conducting science investigations may be
- Be careful with sharp objects and glass. Only the teacher should clean up when something breaks.
- Follow all directions for completing the science investigation.
- Follow proper handling of animals in the classroom.
- Keep objects away from the face unless instructed by the teacher.
- Keep workplace neat. Clean up after an activity.
- Practice all of the safety procedures associated with the activities or investigations conducted.
- Tell the teacher about accidents or spills right away.
- Wash hands after each activity.
- Wear goggles or aprons when appropriate.

**It is essential for students to** use tools safely and accurately when conducting investigations, including thermometers, rain gauges, balances, and measuring cups.

NOTE TO TEACHER (safety while working with students):
- Teacher materials have lists of "Safety Procedures" appropriate for the suggested activities. Students should be able to describe and practice all of the safety procedures associated with the activities they conduct.
- Most simple investigations will not have any risks, as long as proper safety procedures are followed. Proper planning will help identify any potential risks and therefore eliminate any chance for student injury or harm.
- Teachers should review the safety procedures before doing an activity.
- Lab safety rules may be posted in the classroom and/or laboratory where students can view them. Students should be expected to follow these rules.
- A lab safety contract is recommended to notify parents/guardians that classroom science investigations will be hands-on and proper safety procedures will be expected. These contracts should be signed by the student and the parents or guardians and kept on file to protect the student, teacher, school, and school district.
- In the event of a laboratory safety violation or accident, documentation in the form of a written report should be generated. The report should be dated, kept on file, include a signed witness statement (if possible) and be submitted to an administrator.
- Materials Safety Data Sheets (MSDS) will be found in kits if necessary.
- For further training in safety guidelines, you can obtain the SC Lab Safety CD or see the Lab Safety flip-chart (CD with training or flip-chart available from the SC Department of Education).

**Scientific Inquiry**

**2-1 The student will demonstrate an understanding of scientific inquiry, including the processes, skills, and mathematical thinking necessary to conduct a simple scientific investigation.**

**It is not essential for students to** go beyond safety procedures appropriate to the kinds of investigations that are conducted in a second grade classroom.

**Assessment Guidelines:**
The objective of this indicator is to *use* appropriate safety procedures when conducting investigations; therefore, the primary focus of assessment should be to apply correct safety procedures while conducting an investigation. However, appropriate assessments should also require students to *identify* safety procedures that are needed while conducting an investigation; or *recognize* when appropriate safety procedures are being used.